PALOMAR ENERGY PROJECT (01-AFC-24)
CEC STAFF DATA REQUEST NUMBER 1

Technical Area: Air Quality **Response Date: April 8, 2002**

REQUEST:

Please demonstrate that the project will comply with the emission limit of SDAPCD Rule 69.3.1 by calculating the limit from the thermal efficiency of the proposed turbines.

RESPONSE:

SDAPCD Rule 69.3.1 requires compliance with a NO_x emissions concentration for gas turbine engines with power rating of 0.3 MW or greater. When operating on gaseous fuel, the NO_x emissions limit for gas turbines engines with a power rating of 10 MW or greater and post-combustion control in units of ppm_v is 9 * E/25 where E is the unit thermal efficiency per equation 1.

$$E = MRTE * LHV / HHV \qquad \text{(equation 1)}$$

Where:

E = Unit thermal efficiency

MRTE = Manufacturer's Rated Thermal Efficiency

LHV = Lower Heating Value

HHV = Higher Heating Value

Based on Appendix Table E.3-1 of the AFC and Case 7 for the 100% load case, the LHV is 9,410 Btu/kWh and the HHV is 10,436 Btu/kWh. The MRTE corrected to LHV is the inverse of the Heat Rate – LHV with a units conversion as follows.

$$MRTE = 1.06 \text{ E-04 kWh/Btu} * 3412 \text{ Btu/kWh} = 0.3626$$

Then, the unit thermal efficiency, E, is calculated as follows.

$$E = 0.3626 * (9{,}410 \text{ Btu/kWh}) / (10{,}436 \text{ Btu/kWh}) = 32.7\%$$

Note that per the definition of MRTE in SDAPCD Rule 69.3.1, the heat rate of the gas turbine engine was used in this analysis. This heat rate accounts for the backpressure of the control equipment. However, when facility operations are accounted for in combined cycle mode, the heat rate will be lower and therefore the thermal efficiency will be greater.

Finally, the emission limit is calculated as follows.

$$\text{Emission Limit } NO_x \text{ } (ppm_v) = 9 * 32.7 / 25 = 11.8 \text{ } ppm_v$$

Since the permitted emission rate of the combustion turbine is expected to be 2 ppm_v NO_x, the unit will clearly be in compliance with the requirements of SDAPCD Rule 69.3.1.